GEOLOGIC MAPPING OF THE REULL VALLIS REGION OF MARS

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Introduction: Geologic mapping studies coupled with geomorphic analyses are being used to characterize the Reull Vallis outflow channel system and to determine the stratigraphy of the eastern Hellas region of the martian cratered highlands. Geologic studies of the Reull Vallis region examine the roles and timing of volatile-driven erosional and depositional processes and provide constraints on potential associated climatic changes. Current MTM mapping complements earlier investigations of the eastern Hellas region of Mars, including regional analyses [1-3], volcanic studies of Hadriaca and Tyrrhena Paterae [4-6], and mapping studies of highland outflow channels [7]. Key scientific objectives include assessment of mechanisms of highland degradation, the origin and evolution of Reull Vallis, and the role of Reull Vallis in the formation and subsequent dissection of the widespread plains units identified in the region.

Project Status: Analysis of the Reull Vallis region includes preparation of three formal mapping products: (1) Geologic map of MTM -40252 and -40257 quadrangles [8], (2) Geologic map of MTM -45252 and -45257 quadrangles [9], and (3) Geologic map of MTM -30247, -35247, and -40247 quadrangles (compiled on single 1:1M scale base) [10]. Crater-size frequency distributions compiled in the regional study of Mest [6, 11] are being utilized along with photogeologic observations in MTM mapping for martian time-stratigraphic designations. Maps of MTM -40252, -40257, -45252, and -45257 quadrangles have been prepared and submitted in digital format (for current versions of these maps, see http:viking.eps.pitt.edu/~dcrown).

Mapping Results: MTM -40252, -40257, -45252, and -45257 quadrangles contain an extensively modified portion of the highlands of Promethei Terra. Remnants of Noachian highland terrain occur as expanses of cratered terrain and as isolated or clustered massifs. Highland terrains in the region record the effects of diverse, multistage degradational sequences, which in some places may have extended into recent geologic time. Low-lying parts of the Noachian basin-rim unit appear to have been filled with a younger sedimentary deposit that in some cases has been dissected by well-developed, dendritic to rectilinear valley networks. Numerous highland massifs, as well as some crater rims and walls of Reull Vallis, exhibit prominent debris aprons/flows that extend for tens of kilometers. These debris deposits are locally the youngest features throughout the region and their surface morphologies (i.e., lineations, ridges, and pits) are suggestive of incorporation of volatiles, perhaps as interstitial ice, that enhance their mobility. Adjacent to high-standing remnants of the highlands are widespread smooth and channeled plains through which part of Reull Vallis extends. The role of collapse in the evolution of Reull Vallis is clearly indicated by its irregular planform morphology, the occurrence of large slump blocks along its walls, and debris extending from tributary canyons and merging with materials that fill Reull Vallis to different degrees in different locations. Mapping studies have suggested that smooth and channeled plains represent the product of a series of depositional and erosional events tied to large-scale flooding from Reull Vallis and/or deposition of material eroded from the surrounding highlands. Smooth plains, which may have originally been much more extensive, are thought to have been removed to the southwest of Reull Vallis, with local erosion

and redistribution of materials forming the channeled plains. Deposits filling crater interiors and a series of dark ejecta pedestal craters may be evidence for burial and exhumation in areas now covered by channeled plains. Current studies of the Reull Vallis region are incorporating MOLA data and MOC images to assess unit origins and stratigraphic relations derived from MTM mapping.

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